ACCESSION #: 9909210102

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Indian Point 3 PAGE: 1 OF 6

DOCKET NUMBER: 05000286

TITLE: Automatic Reactor Trip Due to Low Low Level in Steam

Generator 33 Caused by Equipment Failure Resulting in

Loss of the 34 Instrument Bus

EVENT DATE: 08/12/1999 LER #: 1999-010-00 REPORT DATE: 09/09/1999

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Troy Schaefer TELEPHONE: (914) 736-8797

Instrumentation and Control Engineer

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: EF COMPONENT: INVT MANUFACTURER: W120

REPORTABLE EPIX: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On August 12, 1999, with the reactor at 100% power, an automatic reactor trip (RT) occurred. The RT occurred after a component failure of the 34 Static Inverter caused a loss of the 34 Instrument Bus (IB). With the loss of the 34 IB, a low low level occurred

on the 33 Steam Generator (S/G). This low low level on 33 S/G was due to the plant's response to an IB failure. This satisfied the Reactor Protection System (RPS) logic of two out of three low low level signals on any one S/G causing the RT. The plant was stabilized in hot shutdown condition and the transient was terminated. Safe Shutdown systems responded as required. The cause of the 34 Instrument Bus (IB) failure was a failed power resistor in the 34 Static Inverter which prevented the Static Inverter from providing proper output to the IB. Significant corrective actions include performing a Failure Analysis on the failed power resistor, replacement of the failed power resistor and other Static Inverter components which failed as a result of the resistor, and evaluating the need for adding an Automatic Bus Transfer system to the 34 Static Inverter. This event qualifies as an unplanned reactor scram with the loss of normal heat removal, but was not a safety system functional failure in accordance with the guidelines of NEI 99-02. This event had no effect on the public health and safety.

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DESCRIPTION OF EVENT

On August 12, 1999, at approximately 0407 hours, with the reactor at approximately 100 percent, an automatic reactor trip (RT) occurred and Auxiliary Feedwater Pumps (AFWP) {BA} were started. The RT and AFWP start occurred as a result of satisfying the two out of three Reactor Protection System (RPS) {JC} logic for 33 Steam Generator (S/G) {AB} low low level (8 percent narrow range). The low low level RT signal was generated as a result of a failure of 34 Static Inverter {INVT} causing a loss of 34 Instrument Bus {BU} (Protection Channel 3). This 34 IB failure caused several plant responses to occur including a main turbine runback and closure of the four feedwater regulating valves isolating main feedwater flow. These responses, combined with the S/G level "shrink" occurrence due to the rapid downpower from the runback, resulted in a lowering level in the four S/Gs with the 33 S/G low low level

occurring first to cause the RT.

The sequence of events for this RT, as determined by the Post Transient Review Group (PTRG) evaluation is discussed below.

Just prior to the RT, at approximately 0407 hours, the Control Room (CR) operators had noticed both a "Spray Additive Tank Low-Low Level" alarm and an "Overpower Delta Temperature Channel Trip or Rod Stop" alarm. Both of these annunciators came up and cleared promptly. During the time frame for acknowledging these annunciators, the 34 Static Inverter failed causing loss of the 34 IB. This caused multiple control room alarms {ALM} to annunciate, a turbine runback to occur, and the four main feedwater regulating valves to close (as their Manual/Automatic control stations were in the Automatic mode).

The turbine runback occurred as a result of satisfying RPS circuitry logic of one out of four high overpower delta temperature runback signals due to loss of the Reactor Coolant System (RCS) average temperature signal to protection channel 3. Because the 34 IB also supplies all four Steam Generator Water Level Control (SGWLC) systems three-element controllers, the four S/G feedwater regulating valves (FRVs){FCV} failed closed into their designed safe position. As a result of the closure of all four FRVs as well as the S/G water level "shrink" condition caused by the runback induced rapid turbine power decrease, a low low level condition occurred on the 33 S/G at approximately 0407 hours.

The turbine runback also caused an increase in RCS {AB} temperature,

which in turn raised Pressurizer (Pzr) pressure. This Pzr pressure increase helped satisfy the necessary logic for actuation of Pzr Power Operated Relief Valve (PORV), PCV-455C {PCV} at approximately 0407 hours. When RCS pressure decreased, some 4 to 6 seconds later, this PORV reseated. The second PORV, PCV-456, did not automatically open since one of its logic inputs was not able to satisfy the requirements to allow automatic opening due to 34 IB failure. This PORV was able to operate manually, if needed.

Following the RT, plant protective equipment operated as expected in response to the event; all RT breakers {BKR} opened, all control rods fully inserted, all three (3) auxiliary feedwater {BA} pumps automatically started. Main feedwater {SJ}, which had already received an isolation signal due to the loss of 34 IB, also received an isolation signal due to the RT combined with a RCS average temperature less than 554 degrees F. The first out annunciator {ACC} on the RT was 33 S/G low level.

Subsequent to the RT, at approximately 0408 hours, the CR operators entered Emergency Operating Procedure (EOP) E-0, "Reactor Trip or Safety Injection", to initiate event recovery and plant stabilization. The operators then transitioned to EOP ES-0.1, "Reactor Trip Response", at approximately 0412 hours, since a Safety Injection (ST) was neither actuated nor required. The CR operators also entered ONOP-EL-3, "Loss of

an Instrument Bus", at approximately 0412 hours.

At approximately 0410 hours, 32 S/G pressure reached approximately 1062 psig, causing one of its Main Steam safety/relief valves {RV}, MS-45-2, to open, not fully close upon pressure decrease, and subsequently open intermittently. The RCS average temperature at this time was 550 degrees F. Valve MS-45-2 opened due to a combination of factors which include: (1) The atmospheric relief valve for 32 S/G, which has its control circuitry powered from the 34 Instrument bus, became de-energized, and (2) The Main Steam {SB} High Pressure (HP) Steam Dumps to the main condenser {SG}, although opening momentarily, did not function due to low RCS average temperature signals in the "Temperature" mode and a de-energized controller in the "Pressure" mode, as a result of the 34 IB de-energization.

At about 0545 hours, the 32 S/G safety/relief valve started to open and was reseated when operators lowered RCS average temperature and S/G pressure stabilized at approximately 980 psig. The 34 IB was re-energized via backup power supply from Motor Control Center (MCC) 36C {ED} at approximately 0550 hours. This action was not taken until 0550 hours because Operations was determining why the 34 Static Inverter had tripped and whether the 34 IB should be re-energized. The 32 S/G atmospheric relief valve and the HP steam dumps were also placed into service at approximately 0550 hours, when 34 Instrument bus power was restored. At approximately 0620 hours, RCS average temperature was

stable at 547 degrees F and the plant was maintained in the hot shutdown condition.

An investigation into the cause of the trip was initiated and a post transient evaluation was performed. Troubleshooting on the failed 34 Static Inverter determined the Static Inverter failed as follows: Static Inverter power resistor (R4) failed which caused the gating and synchronization board to fail. This caused the gate driver board to fail sending improper gating pulses to the silicon controlled rectifier (SCR). The timing sequence for the SCR was adversely affected causing fuse (1FU) to clear (fail), which caused loss of the negative DC feed to the inverter. The Static Inverter was unable to generate any output and the 34 IB became de-energized. The failed resistor was sent to an independent engineering consultant for Failure Analysis. The 34 Static Inverter is a Westinghouse 7.5kVA type which has no automatic transfer capability to a backup power supply.

Equipment that did not function or operate as expected following the trip consisted of the 31 ABFP inboard packing which was steaming from the inboard gland, the Fire Protection Carbon Dioxide (CO2) system {LW} around the 32 Main Boiler Feed Pump which discharged, and Reheater Steam Shutoff valve (MSMOV-6-4) which did not reclose following the RT. At approximately 0416 hours, the 31 ABFP Inboard Gland was observed to be steaming. Maintenance personnel adjusted the gland at approximately 0445

hours. This adjustment successfully returned the pump inboard gland temperature to normal. The 33 ABFP was also inspected and determined that its glands were operating properly. The CO2 system experienced a brief discharge around the 32 MBFP which occurred at approximately 0416 hours. Preliminary investigation determined that the CO2 discharge did not directly occur because of the loss of power from 34 IB, but because of a fault in the detection circuit or a sensitive heat detector (potential for steam release nearby). Local examination by engineering personnel as well as discussion with the MBFP vendor indicated that this CO2 discharge had no effect on the form, fit or function of the 32 MBFP itself. Reheater Steam Shutoff Valve, MOV-MS-6-4, was found to be stuck open after the RT. This valve required repair to its manual drive sleeve and limit switch paddle gear, which was completed by Maintenance personnel to support the startup. When plant operation was commenced several days after the RT, increased RCS leakage was experienced due to the Reactor Head Vent valves. Because this RCS leakage was experienced after recovery from this RT event, it is reasonable to conclude that the RT transient which caused an increase in RCS pressure and temperature, possibly caused this observed leakage.

At 0750 hours, a four hour non-emergency notification (Incident Log No. 36023) was made to the NRC for an RPS/AFW actuation. An updated non-emergency notification was made at 1306 on August 13, 1999 to clarify that a PORV did lift and reseat and that no Pzr safety valves lifted.

The emergency notification update also indicated that a news release was made as of 1100 on August 12, 1999.

CAUSE OF EVENT

The direct cause of the RT was the 33 S/G low low level (8 percent narrow range) RPS actuation, satisfied by two out of three level channels, due to loss of the 34 Static Inverter and the 34 IB resulting from the loss of a power resistor in the 34 Static Invertor.

CORRECTIVE ACTIONS

The following corrective actions have been or will be performed under the Authority's corrective action program to address the cause of this event:

. A Post Transient Review by the PTRG was performed for this event.

. The failed power resistor, and those components within the 34 Static Inverter which also failed as a result of the failed resistor, were replaced. Successful testing was performed and the Static Inverter returned to service supplying the 34 IB prior to the subsequent Reactor startup.

. The failed power resistor from the 34 Static Inverter was sent offsite for Failure Analysis and results of this will be addressed in the Authority's corrective action program.

. The need for adding an Automatic Bus Transfer System to the 34 Static Inverter will be evaluated.

Additional enhancements decided as a result of this RT will be tracked

internally within the Authority's corrective action program.

ANALYSIS OF THE EVENT

This event is reportable under 10 CFR 50.73 (a) (2) (iv). The licensee shall report any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

This event meets the reporting criteria because an automatic RT occurred as a result of satisfying the reactor protection system (RPS) logic for a reactor trip. Two out of three S/G low low level signals in a single S/G (33) generated the trip signal after a loss of 34 Instrument Bus. Auxiliary feedwater automatically started in response to the RT. In response to the event, Operations notified the NRC of an RPS actuation in accordance with 10 CFR 50.72 (b) (2) (ii), ENS Log No. 36023.

A review of the past two years of Licensee Event Reports (LERs) for events that involve reactor trip caused by equipment failure identified LER 97-025 and LER 98-006. These LERs involved failure of high resistance contacts which are unrelated to a resistor failure. LER 87-002 identified a tripping of 34 Static Inverter due to an overcurrent condition caused by a short-circuited solenoid valve, a different failure mechanism. Following the 1987 event, the design of 34 Static Inverter was improved to allow isolation of single branch circuits if a short circuit develops.

SAFETY SIGNIFICANCE

This event had no effect on the health and safety of the public. There were no actual safety consequences for the event because the safety functions were performed as designed when the reactor tripped after the conditions for automatic RT were satisfied. The RT on low low S/G level is designed to protect the reactor from a loss of heat sink for the case of a sustained steam flow/feed flow mismatch which is too small to be detected.

This event qualifies as an unplanned reactor scram with loss of normal heat removal in accordance with the guidelines of Nuclear Energy Institute (NEI) 99-02 Draft Rev. B, "Regulatory Assessment Performance Indicator Guideline." The unplanned scram involved a loss of normal heat removal pathway via the main condenser due to a loss of main feedwater. The event was assessed for possible candidates as safety system functional failures (SSFFs). The lifting of one of the pressurizer PORVs did not meet the Performance Indicator (PI) functional failure criteria for primary system safety and relief. The failure of the 34 inverter did not meet the PI criteria for a functional failure of emergency AC and DC power and there was no failure of the reactor protection system. Therefore, the event did not experience any SSFFs because there was no failure of instrumentation, distribution, and environmental control systems that prevented or could have prevented the fulfillment function to provide emergency AC and DC power, nor was there a reactor scram

function. The PORV lift was as per design and no or code limit was or could have been exceeded.

There were no potential safety consequences of the event under the postulated design basis accident conditions. The plant protection systems are designed to fail into a safe state, as they did when the 34 Static Inverter was lost and de-energized the 34 IB. The RT is a fail safe condition. The PORVs operated as designed for transients. One PORV automatically operated and the second PORV, by design was unable to automatically open but was available for manual operation. The Pzr Safety Valves, that are designed for safety functions, would have been available if the PORVs had not been available.

Indian Point 3

Nuclear Power Plant

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Robert J. Barrett

Site Executive Officer

New York Power

Authority

September 9, 1999

IPN-99-097

U.S. Nuclear Regulatory Commission

ATTN: Document Control Desk

Washington, D.C. 20555

Subject: Indian Point 3 Nuclear Power Plant

Docket No. 50-286

License No. DPR-64

Licensee Event Report # 1 999-010-00

Automatic Reactor Trip Due to Low Low Level in Steam

Generator 33 Caused by Equipment Failure Resulting in Loss of the 34

Instrument Bus

Dear Sir:

The attached Licensee Event Report (LER) 1999-010-00 is hereby submitted

as required by 10 CFR 50.73. This event is of the type defined in 10 CFR

50.73 (a) (2) (iv).

The authority is making no new commitments in this LER.

Very truly yours,

Robert J. Barrett

Site Executive Officer

Indian Point 3 Nuclear Power Plant

cc: See next page

Docket No. 50-286

IPN-99-097

cc: Mr. Hubert J. Miller

Regional Administrator

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